

Appendix H

Cost Analysis Example

**For a Typical Small Business Complying with the
Proposed ATCM Requirements**

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Background

The following is an example of a cost analysis for a typical small business complying with the proposed ATCM requirements. Small businesses typically have five or fewer portable diesel-fueled engines, with the average small business owning three engines.

The small business (Company A) fleet consists of:

- 78-horsepower (hp) certified engine (manufactured 1998)
- 129-hp non-certified engine (manufactured 1988)
- 363-hp non-certified engine (manufactured 1988)

These engines reflect the size and age for the average engine in a typical fleet.

Complying with 2010 requirement

To comply with the 2010 requirement, the 129-hp and 363-hp engine would need to be replaced. The 78-hp engine is already a certified engine.

Cost for replacement is assumed to be \$220 per horsepower. This is based upon complete replacement of an existing unit, including engine and related engine equipment, trailer, and enclosure. Cost can be lower, particularly if an owner elects to repower or replace the existing engine versus total replacement of the unit.

129-hp engine: replacement engine costs = \$28,380

363-hp engine: replacement engine costs = \$79,860

The cost for early replacement of the above engines would be based on: 1) the loss of useful life resulting from complying with the regulation, which is the difference between 25 years (assumed useful life of a diesel engine) and the age of the engines at time of replacement (or 2010), and 2) the value for each year of useful life, which is based upon the annualized cost of an engine over 25 years at an effective interest rate of 5 percent.

The annualized cost for the engines are:

129-hp engine: \$2,060/year

363-hp engine: \$5,790/year

As of January 1, 2010, each engine would have a remaining useful life of three years (2010 - 1988 = 22 years). Therefore, the cost for compliance with the 2010 requirement would be:

129-hp engine: \$2,060 each year 2010 to 2012 inclusive = \$6,180, which has a present worth value of \$3,986

363-hp engine: \$5,790 each year 2010 to 2012 inclusive = \$17,370, which has a present worth value of \$11,205

Complying with 2013 fleet standards

Company A is subject to two fleet standards on January 1, 2013. The 78-hp and 129-hp engines must satisfy the fleet average of 0.3 g/bhp-hr that applies to engines that are less than 175-hp. Similarly, the 363-hp engine must satisfy the fleet average of 0.15 g/bhp-hr for engines 175-749 hp.

$$\begin{aligned} <175\text{-hp fleet average} &= (78\text{-hp} \cdot 0.69 \text{ g/bhp-hr} + 129\text{-hp} \cdot 0.22 \text{ g/bhp-hr}) / (78\text{-hp} + 129\text{-hp}) \end{aligned}$$

$$= 0.397 \text{ g/bhp-hr}$$

$$>175\text{-hp fleet average} = (363\text{-hp} \cdot 0.15 \text{ g/bhp-hr}) / 363\text{-hp}$$

$$= 0.15 \text{ g/bhp-hr}$$

To comply with the 2013 fleet requirement, Company A will need to replace the 78-hp engine. Because the 129-hp and 363-hp engines were replaced to satisfy the 2010 requirement, these engines are certified to Tier 2/3 levels. Tier 2/3 engines would individually comply with the 2013 fleet standards.

If the 78-hp engine, which is certified to a Tier 1 level (no PM standard is applicable for Tier 1 engines of this size), were replaced with an engine certified to Tier 2/3 levels, Company A's fleet average for the <175-hp fleet average would be 0.25 g/bhp-hr.

Using the same criteria used above to assess the economic impact to replace the 129-hp and 363-hp engines, the following would apply for replacing the 78-hp engine:

- Replacement engine costs = \$17,160
- The annualized cost = \$1,241/year
- At 2013, the engine would have a remaining useful life of 10 years (2013 – 1998 = 15 years)

The cost for compliance with the 2013 requirement would be:

\$1,241 each year 2013 to 2022 inclusive = \$12,410, which has a present worth value of \$5,882.

Complying with 2017 fleet standards

Company A is subject to two new fleet standards on January 1, 2017. The 78-hp and 129-hp engines must satisfy a fleet average of 0.18 g/bhp-hr that applies to engines that are less than 175 hp. Similarly, the 363-hp engine must satisfy a fleet average of 0.08 g/bhp-hr for engines 175 to 749 hp. To comply with the 2017 fleet requirement, Company A will need to retrofit the 129-hp engine and 363-hp engine with particulate filters. In these calculations, the filter is assumed to be 85 percent efficient or to reduce the engine's diesel PM emissions to 15 percent of engine's certified emission levels.

$$\begin{aligned} <175\text{-hp fleet average} &= (78\text{-hp} * 0.3 \text{ g/bhp-hr} + 129\text{-hp} * 0.22 \text{ g/bhp-hr} * 0.15 \\ &\quad \text{control factor}) / (78\text{-hp} + 129\text{-hp}) \\ &= 0.13 \text{ g/bhp-hr} \end{aligned}$$

$$\begin{aligned} >175\text{-hp fleet average} &= 363\text{-hp} * 0.15 \text{ g/bhp-hr} * 0.15 \text{ control factor} / 363\text{-hp} \\ &= 0.02 \text{ g/bhp-hr} \end{aligned}$$

Note that Company A is now in compliance with the 2020 fleet standard for engines rated between 175 to 749 hp.

To assess the economic impact of adding particulate filters, the cost was based upon \$40 per hp.

129-hp engine: filter costs of \$5,160

363-hp engine: replacement engine costs \$14,520

The cost was annualized over a 10 year period at an effective interest rate of 5 percent. The annualized cost for the filters are:

129-hp engine: \$1,000/year

363-hp engine: \$2,220/year

In summary, the cost for satisfying the 2017 fleet standard would be:

129-hp engine: \$1,000 each year 2016 to 2025 inclusive = \$10,000, which has a present worth value of \$4,094)

363-hp engine: \$2,220 each year 2016 to 2025 inclusive = \$22,200, which has a present worth value of \$9,090)

Complying with 2020 fleet standards

To comply with the 2020 fleet standards for engines rated at less than 175 hp, Company A will need to retrofit the 78-hp engine with a particulate filter.

Using the same criteria used above to assess the economic impact for adding particulate filters to the 129-hp and 363-hp engines, the following would apply for the 78-hp engine:

- Filter costs = \$3,140
- Annualized costs of filter = \$730 a year

Cost for compliance would be \$730 each year from 2019 to 2028 inclusive (\$7,300, which has a present worth value of \$2,263)

Total costs (present worth in 2002 dollars)

The total costs for the small business would be about \$36,500, with the cost occurring from 2010 to 2028.